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Packing Eggs for Export at the South Queensland Egg Marketing Board's Premises, Brisbane.

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Berkshire.

A. P. and N. Beatty, "Deepdene," Barambah road, Nanango
S. Cochrane, "Stanroy" Stud, Felton
J. L. Handley, "Meadow Vale" Stud, Lockyer
O'Brien and Hickey, "Kildurham" Stud, Jandowae East
G. C. Traves, "Wynwood" Stud, Oakey
Westbrook Farm Home for Boys, Westbrook
H.M. State Farm, "Palen" Stud, Palen Creek
A. R. Ludwig and Sons, "Beau View" Stud, Beaudesert
D. T. Law, "Rossvill" Stud, Trouts road, Aspley
R. H. Crawley, "Rockthorpe" Stud, *via* Pittsworth
F. R. J. Cook, Middle Creek, Pomona
Mrs. I. M. James, "Kenmore" Stud, Cambooya
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H.M. State Farm, Numinbah
M. G. and R. H. Atkins, "Diamond Valley" Stud, Mooloolah
E. J. Clarke, "Kaloon" Stud, Templin
L. Puschmann, "Tayfeld" Stud, Taylor
C. E. Edwards, "Spring Valley" Stud, Kingaroy
G. McLennan, "Murcott" Stud, Willowvale
H. M. Wyatte, "Cumberland Vale," Cooyar
C. F. W. and B. A. Shellback, "Redvilla" Stud, Kingaroy
J. C. Lees, "Bridge View" Stud, Yandina
F. Thomas, "Rosevale" Stud, M.S. 373, Beaudesert
A. C. Fletcher, "Myola" Stud, Jimbour
Q.A.H.S. and College, Lawes
E. F. Smythe, "Grandmere" Stud, Manyung, Murgon
The Marsden Home for Boys, Kallangur
M. F. Callaghan, Lower Mount Walker, *via* Rosewood
E. R. Kimber, Block 11, Mundubbera
A. J. Potter, "Woodlands," Inglewood
Regional Experiment Station, Hermitage
J. W. Bukowski, "Secreto" Stud, Oxley
R. Astbury, "Rangvilla," Pechey.
L. Pick, Mulgildie.
D. G. Grayson, Killarney

Large White.

H. J. Franke and Sons, "Delvue" Stud, Cawdor
Garrawin Stud Farm Pty. Ltd., 657 Sandgate road, Clayfield
J. A. Heading, "Highfields," Murgon
K. B. Jones, "Cefn" Stud, Pilton
R. Postle, "Yarralla" Stud, Pittsworth
B. J. Jensen, "Bremerside" Stud, Rosevale, *via* Rosewood
E. J. Bell, "Dorne" Stud, Chinchilla
L. C. Lobegeiger, "Bremer Valley" Stud, Moorang, *via* Rosewood
H. R. Gibson, "Thistleton" Stud, Maleny
H.M. State Farm, Numinbah
V. P. McGoldrick, "Fairymeadow" Stud, Cooroy
S. T. Fowler, "Kenstan" Stud, Pittsworth
W. Zahnow, Rosevale, *via* Rosewood
Regional Experiment Station, Biloela
G. J. Hutton, "Grajea" Stud, D'Aguilar
H. L. Larsen, "Oakway," Kingaroy
G. I. Skyring, "Bellwood" Stud, *via* Pomona
O. B. Vidler, Manneum, Kingaroy
K. F. Stumer, French's Creek, Boonah
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R. S. Powell, "Kybong" Stud, Kybong, *via* Gympie
C. Wharton, "Central Burnett" Stud, Gayndah
S. Jensen, Rosevale, *via* Rosewood
V. V. Radel, Coalstoun Lakes
H. R. Stanton, Tansey, *via* Goomeri
L. Stewart, Mulgowie, *via* Laidley
D. T. Law, "Rossvill" Stud, Trouts road, Aspley
O. J. Horton, "Manneum Brae" Stud, Manneum, Kingaroy.
B. F. Jensen, Rosevale

Tamworth.

D. F. L. Skerman, "Waverley" Stud, Kaimkillenbun
A. C. Fletcher, "Myola" Stud, Jimbour
Salvation Army Home for Boys, "Canaan" Stud, Riverview
Department of Agriculture and Stock, Regional Experiment Station, Kairi
E. C. Phillips, "Sunny View," M.S. 90, Kingaroy
F. N. Hales, Kerry road, Beaudesert
T. A. Stephen, "Withcott," Helidon
W. F. Kajewski, "Glenroy" Stud, Glencoe
A. Herbst, "Hillbanside" Stud, Bahr Scrub, *via* Beenleigh
F. Thomas, "Rosevale" Stud, M.S. 373, Beaudesert
H. J. Armstrong, "Alhambra," Crownthorpe, Murgon
R. H. Coller, Tallegalla, *via* Rosewood
A. J. Potter, "Woodlands," Inglewood
D. V. and P. V. Campbell, "Lawn Hill," Lamington
S. Kanowski, "Miecho" Stud, Pinelands
N. R. Potter, "Actonvale" Stud, Wellcamp

Wessex Saddleback.

W. S. Douglas, "Greylight" Stud, Goombungee
C. R. Smith, "Belton Park" Stud, Nara
H. H. Sellars, "Tabooba" Stud, Beaudesert
D. T. Law, "Rossvill" Stud, Trouts road, Aspley
J. B. Dunlop, "Kurrawyn" Stud, Acacia road, Kuraby
R. A. Collings, "Rutholme" Stud, Waterford
M. Nielsen, "Cressbrook" Stud, Goomburra
G. J. Cooper, "Cedar Glen" Stud, Yarraman
"Wattledale Stud," 492 Beenleigh road, Sunnybank.
Kruger and Sons, "Greyhurst," Goombungee
A. Scott, "Wanstead" Stud, Grantham

British Large Black.

H. W. Naumann, "Parkdale" Stud, Kalbar

Tuberculosis-Free Cattle Herds.

The studs listed below have fulfilled the conditions of the Department's Tuberculosis-free Herd Scheme to 31st December, 1956.

Breed.	Owner's Name and Address.
A.I.S.	M. E. & E. Scott, "Wattlebrae" A.I.S. Stud, Kingaroy
	F. B. Sullivan, "Fermanagh," Pittsworth
	D. Sullivan, "Bantry" Stud, Rossvale, *via* Pittsworth
	W. Henschell, "Yarranvale," Yarranlea
	Con. O'Sullivan, "Navillus" Stud, Greenmount
	H. V. Littleton, "Wongalea" Stud, Hillview, Crow's Nest
	J. Phillips and Sons, "Sunny View," Benair, *via* Kingaroy
	Sullivan Bros., "Valera" Stud, Pittsworth
	Reushle Bros., "Reubydale" Stud, Ravensbourne
	H. F. Marquardt, "Chelmer" Stud, Wondai
	A. C. and C. R. Marquardt, "Cedar Valley," Wondai
	A. H. Sokoll, "Sunny Crest" Stud, Wondai
	W. and A. G. Scott, "Welena" A.I.S. Stud, Blackbutt
	G. Sperling, "Kooravale" Stud, Kooralgin, *via* Cooyar
	C. J. Schloss, "Shady Glen," Rocky Creek, Yarraman
	W. H. Thompson, "Alfa Vale," Nanango
	S. R. Moore, Sunnyside, West Wooroolin
	H.M. State Farm, Numinbah
	D. G. Neale, "Groveley," Greenmount
	Edwards Bros., "Spring Valley" A.I.S. Stud, Kingaroy
	A. W. Wieland, "Milhaven" A.I.S. Stud, Milford, *via* Boonah
	W. D. Davis, "Wamba" Stud, Chinchilla
	Queensland Agricultural High School and College, Lawes
	C. K. Roche, Freestone, Warwick
	Mrs. K. Henry, Greenmount
	D. B. Green, "Deloraine" Stud, Durong, Proston
	E. Evans, Wootha, Maleny
	T. L. and L. M. J. Cox, "Seafield Farm," Wallumbilla
	J. Crookey, "Arolla A.I.S. Stud" Fairview, Allora
	M. F. Power, "Barfield," Kapaldo
	A. H. Webster, "Millievale," Derrymore
	W. H. Sanderson, "Sunlit Farm," Mulgildie
	R. A. and N. K. Shelton, "Vuegon" A.I.S. Stud, Hivesville, via Murgon
	R. R. Radel & Sons, "Happy Valley," Coalstoun Lakes
Ayrshire	L. Holmes, "Benbecula," Yarranlea
	J. N. Scott, "Auchen Eden," Camp Mountain
	E. Mathie and Son, "Ainslie" Ayrshire Stud, Maleny
	C. E. R. Dudgeon, "Marionville" Ayrshire Stud, Landsborough
	G. F. H. Zerner, "Pineville," Pie Creek, Box 5, P.O., Gympie
	T. F. Dunn, Alanbank, Gleneagle
Friesian	C. H. Naumann, "Yarrabine" Stud, Yarraman
	D. J. Pender, "Camelot," Lytton road, Lindum
	S. E. G. Macdonald, "Freshfields," Marburg
Guernsey	C. D. Holmes, "Springview," Yarraman
	A. B. Fletcher, Cossart Vale, Boonah
	W. H. Doss, Degilbo, *via* Biggenden
	A. C. Swendson, Coolabunia, Box 26, Kingaroy
	C. Scott, "Coralgrae," Din Din road, Nanango
	R. J. Wissemann, "Robnea," Headington Hill, Clifton
	G. L. Johnson, "Old Cannindah," Monto
	A. Ruge & Sons, Woowoonga, *via* Biggenden
	G. Miller, Armagh Guernsey Stud, Armagh, M.S. 428 Grantham
Jersey	Queensland Agricultural High School and College, Lawes
	J. S. McCarthy, "Glen Erin" Jersey Stud, Greenmount
	J. F. Lau, "Rosallen" Jersey Stud, Goombungee
	G. Harley, Hopewell, M.S. 189, Kingaroy
	Toowoomba Mental Hospital, Willowburn
	Farm Home for Boys, Westbrook
	F. J. Cox and Sons, "Rosel" Stud, Crawford, Kingaroy Line
	P. J. L. Bygrave, "The Craigan Farm," Aspley
	R. J. Crawford, "Inverlaw" Jersey Stud, Inverlaw, Kingaroy
	P. H. F. Gregory, "Carlton," Rosevale, *via* Rosewood
	E. A. Matthews, "Yarradale," Yarraman
	A. L. Semgreen, "Tecoma," Coolabunia
	L. E. Meier, "Ardath" Stud, Boonah
	A. M. and L. J. Noone, "Winbirra" Stud, Mt. Esk Pocket, Esk
	W. S. Conochie and Sons, "Brookland" Stud, Sherwood road, Sherwood
	Estate of J. A. Scott, "Kiaora," Manumbar road, Nanango
	F. W. Verrall, "Coleburn," Walloon
	C. Beckingham, Trouts road, Everton Park
	W. E. O. Meier and Son, "Kingsford" Stud, Alberton, *via* Yatala
	G. H. Ralph, "Ryecombe," Ravensbourne
	Mrs. I. L. M. Borchert, "Willowbank" Jersey Stud, Kingaroy
	W. and C. E. Tudor, "Boree" Jersey Stud, M.S. 498, Gayndah
	Weldon Bros., "Gleneden" Jersey Stud, Upper Yarraman
	D. R. Hutton, "Bellgarth," Cunningham, *via* Warwick
	J. W. Carpenter, Flagstone Creek, Helidon
	H. G. Johnson, "Windsor" Jersey Stud, Beaudesert
	W. S. Kirby, Tinana, Maryborough
	S. A. Cramb, "Trecarne Stud," Lockyer
	G. & V. Beattie, "Beauvern," Antigua, Maryborough
	J. A. & E. E. Smith, "Heatherlea" Jersey Stud, Chinchilla
	W. C. M. Birt, "Pine Hill" Jersey Stud, Gundiah
	T. Nock, Dallarnil
	P. Fowler & Sons, "Northlea," Coalstoun Lakes
	F. Porter, Conondale
	H.M. State Farm, Palen Creek
Poll Hereford ..	W. Maller, "Boreview," Pickanjinnie
	J. H. Anderson, "Inverary," Yandilla
	D. R. and M. E. Hutton, "Bellgarth," Cunningham, *via* Warwick
	E. W. G. McCamley, Eulogie Park, Dululu
	Wilson and McDouall, Calliope Station, Calliope

NEW YEAR MESSAGE FROM THE MINISTER FOR AGRICULTURE AND STOCK.

«»

The past year has underlined, if it needed any emphasis, the way in which both State and National prosperity are inescapably tied to primary production.

Every individual and every community feels the impact of falling export and internal revenues resulting from smaller movements of primary produce to export markets, from lower prices for farm products, and from shrinking overseas markets.

In such circumstances, producers and Governments cannot afford to stand aloof from one another but must pull together for the common good. I am pleased to be able to say that, though it is difficult at times to reconcile conflicting viewpoints, producers' organisations and Governmental bodies are in most cases working harmoniously to overcome marketing difficulties.

The year ahead will undoubtedly bring further problems of production and distribution, but I am confident that the challenge will be met with the initiative and resourcefulness that characterise the primary producer.

I would like to give a special word of encouragement to newcomers to Australia who have settled on the land in Queensland. Earlier immigrants and their families have prospered here and have made a tremendous contribution to the development of the State. The same opportunities lie before the newer settlers.

To all on the land I extend very best wishes for 1957.

W. H. Collins

SKELETON WEED IS HERE—WATCH FOR IT!

Send specimens of any unusual rosette plant to the Government Botanist, Department of Agriculture and Stock, Brisbane, for identification. Skeleton weed could ruin your property if it became established.

Better Quality Dairy Products

By E. B. RICE, Director of Dairying.

Australia is one of the main dairy produce exporting countries in the world. Most of the exportable surplus is shipped to the British market, where it has to face the competition of the surplus products of the leading dairying countries.

During a recent overseas visit the writer was afforded the opportunity of seeing something of marketing conditions in Britain and of having discussions with various people connected with the dairy produce trade there.

It was generally agreed that in flavour choice Queensland butter does not suffer by comparison with the butter of any other country and its body and texture are firmer.

However, in contrast with most leading dairying countries which export only a uniform quality butter, our butter is of several grades and the percentage of choice is far outweighed by lower grades. This lack of uniformity is an initial marketing disadvantage.

The average standards of construction and equipment of Queensland butter factories are considered to be at least equal to those of European countries and, provided high quality cream is sent to them, they can manufacture it into top quality butter.

As the flavour of the resultant butter is dependent almost entirely on the quality of the cream from which it is produced, it is clear that improvement in the quality of cream supplies received at our factories is the direction in which every effort must be exerted if our butter is to gain a good reputation on export markets. No protection against substitutes can be looked for on the British market and the purchasers can only be expected to appreciate and buy butter if its flavour is more appealing than that of an alternative product.

During recent months the demand for cheese on export markets has been strong and prices have been relatively better than for butter. There are, however, serious faults in Queensland cheese exports. Some of these can be attributed to the quality of the milk from which the cheese is manufactured, and some to manufacture or care of the cheese after manufacture. The flavour does not compare favourably with that of the cheese from other countries and this is primarily due to the milk quality. On the other hand, the cheese does not cut well, which is very important from the viewpoint of the shopkeeper. This is attributed partly to the milk quality and partly to manufacturing technique. Crown-rot and cracked rinds, two common defects in the body and texture of our cheese in Britain, are due to faulty handling at the factories. Failure to turn the cheese daily during the first 10-14 days and exposure to unsatisfactory temperature and humidity conditions during the time it is held at the factories prior to shipment are probably mainly responsible for these defects.

There is a distinct trend towards the self-service store in most countries and this could give a stimulus to the sale of natural cheddar cheese provided it is packed attractively in retail-size packages with a metal-foil

or plastic covering. It is, of course, essential for a high quality product to be within the wrapper.

The foregoing observations reveal that there must be developed among all associated with the dairying industry of this State a consciousness of the necessity to improve the quality of our products. This boils down to attention by *every* dairy farmer to the following fundamental points:—

(1) Milk and cream must be produced under clean methods.

(2) Utensils and equipment (especially milking machines) must be thoroughly cleaned and sterilized after each milking.

(3) Milk and cream must be cooled and kept cool until sent to the factory.

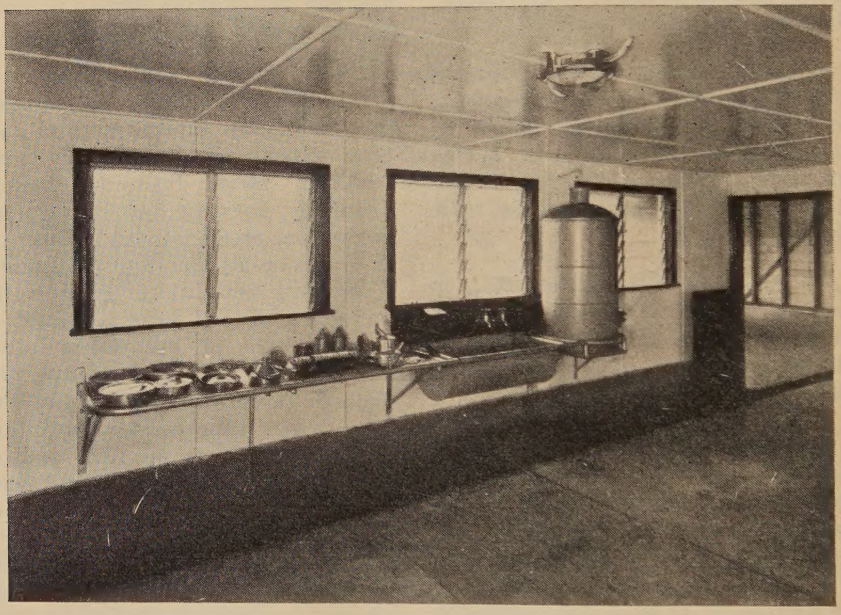

Plate 1.

A Soundly Constructed, Properly Equipped Dairy is Conducive to the Production of High Quality Milk and Cream.

JOURNAL SUBSCRIPTION RATE.

The annual subscription to primary producers, students, schools and Schools of Arts in Queensland is now five shillings.

The cost to others, including interstate and overseas subscribers, is £1 a year.

Tea Growing Experiments in North Queensland

By T. G. GRAHAM (formerly Officer-in-Charge, Bureau of Tropical Agriculture, South Johnstone).*

(*Continued from page 674 of the December issue.*)

HARVESTING.

In order to leave sufficient foliage on the bush, it is customary to defer plucking until a bud and four leaves develop above the "fish" leaf, which is a small, non-serrated leaf appearing first on any new growth.

Plucking varies slightly from one tea producing country to another, but consists essentially of removing the young growing portions of the plant as (*a*) a bud and two leaves, (*b*) a bud and three leaves, or (*c*) a bud and two leaves plus the third leaf (that is, eliminating the length of stem between the second and third leaves). Recently, this last standard has been adopted for hand-plucking at South Johnstone. It is slow but aims at producing a higher quality tea than (*b*).

The plucked leaf is placed in a container and removed to the factory as soon as possible, care being taken to avoid compacting the leaf in transit. Fresh leaf may heat up rapidly and deteriorate before reaching the withering table unless carefully handled.

NOTES ON TEA MANUFACTURE.

In order to obtain tests by trade tea tasters, it was necessary to develop a small tea-curing outfit at the Bureau of Tropical Agriculture.

The process of manufacturing consists of:—(1) withering the fresh leaf to evaporate some of the moisture; (2) rolling the leaf to break up the cells and liberate the juice; (3) oxidizing the leaf to develop quality and colour; (4) final drying, or firing, to arrest oxidation and prevent mould development.

These processes were followed and the general details of the methods employed to produce experimental samples of tea with improvised equipment are as follows.

Withering.

Withering is the important initial step in the process of manufacture, but it is straightforward and does not demand any special equipment. The object is to reduce the moisture content of the leaf, causing it to wilt. When the leaf is in this condition, its cells can be ruptured in the rolling process without actually shattering the leaf.

Withering lofts, consisting of a series of "tats" or shelves constructed of hessian and which can be ventilated at will, are generally used to facilitate the process. At the Bureau, the leaf is merely spread thinly on a table in a room where the circulation of air can be regulated to some extent.

The speed of wilting varies in accordance with prevailing conditions, but the process usually takes from 18 to 22 hours. In practice, it is not difficult to decide when correct "wither" has been reached. A 55 per cent. wither is usually aimed at where rolling machines are used. At South Johnstone, the wither has rarely been taken as low as this because of the hand-rolling methods employed. As the leaf approaches this state, a fruity aroma similar to that of ripe apples is noticeable.

---

* Now Agrostologist stationed at Rockhampton.

Rolling.

Rolling is employed to rupture the cells and liberate the sap without unduly shattering the leaf. In tea producing countries, this process is carried out by machine. The traditional method of rolling was by means of epicyclic rollers, but in more recent years double-action rollers have been more generally used. To date, however, it has not been possible to either procure or improvise a small mechanical roller for use at the Bureau.

The aim of the Station's work has been to produce a conventional tea comparable with the imported article. In the absence of suitable rolling machines, certain makeshifts were tried (for example, a domestic mincing machine), but without any success. As a result, hand-rolling had to be resorted to.

While hand-rolling proved to be slow, tedious and variable in its results, it could be made to fulfil its intended function and produce tea of acceptable quality. More recently the practice of rolling with the feet has been adopted. By this means, more pressure is exerted on the leaf with a minimum of effort, and the efficiency of rolling is appreciably improved.

When rolling is completed, the leaf begins to change colour. The stems first assume a coppery appearance, then all the leaf material gradually changes from a dark green to a coppery shade. The material is graded after leaving the rollers, and the coarser material returned for further rolling.

Oxidizing.

The "oxidizing" or "fermentation" process is without doubt the most important stage in the process of preparation of black tea. During its course, certain constituents of the cell sap are oxidized through the action of a naturally occurring enzyme (or ferment) in the leaf material.

The main purpose of the rolling process is to squeeze out a considerable portion of the cell sap onto the surface of the leaf fragments so that the oxidation process can readily occur. The change in colour at the conclusion of rolling (referred to in the previous section) is the first visible evidence of this oxidation process.

If a tea is brewed from unfermented (that is, green) leaf, it has a raw or metallic taste and little colour. If the leaf is partially fermented or oxidized, the cell constituents turn a reddish colour and the liquor made from the leaf is more richly coloured and mellow flavoured. If oxidation is carried too far the cell substances turn a dark-brown colour, which is reflected in the deep colour of the brewed liquor. During these later stages of oxidation, however, the flavour is considered to lose something of its pungency and become a little flat.

It is important therefore from the viewpoint of flavour that the oxidation process should be carried far enough but not too far. The diagram in Plate 6 (adapted from E. L. Keegal: "Tea Manufacture in Ceylon", 1956) illustrates these points.

It is customary to spread the rolled leaf (or "dhool") on to the fermenting trays or racks to a depth of approximately 2 in. The fermentation process has been found to be most active within the range of 80-90 deg. F. Below 70 deg. F. the process is very slow, and above 150 deg. F. the process is completely arrested. Fermentation times vary from about 3 to 5 hours, depending upon temperature and other conditions.

At South Johnstone, the dhool was spread on glass trays for oxidation, and the latter process was normally completed in 4 hours. Under cooler-than-average conditions, the process might require up to 6 hours.

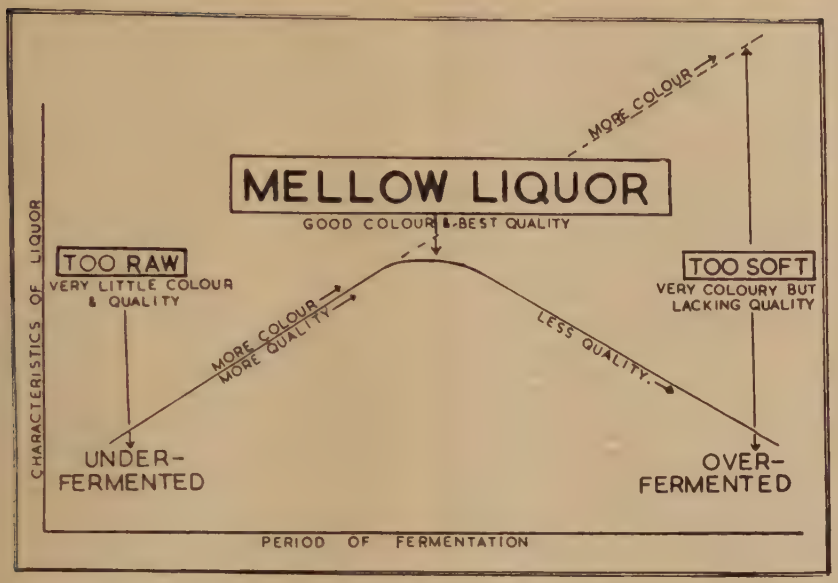

Plate 6.

Diagram Showing the Main Principles of Oxidizing or Fermenting the Leaf.

The slightest suggestion of acidity spoils the flavour of the tea. The development of acidity is normally due to the action of bacteria which have been brought in from outside. The best insurance against this trouble is therefore normal care and cleanliness throughout the manufacturing processes.

Firing.

When oxidation has proceeded far enough, the tea is taken immediately to the drying oven, where fixing and drying take place. The main purpose of the firing process are (i) to drive off all excess moisture, and (ii) by so doing, to check the fermentation process and fix the quality of the leaf.

Early attempts to promote satisfactory drying at South Johnstone were ineffective, but eventually an electric heater and blower were used. The blower had previously been used to blow heated air into a grass-drying chamber. It was now reversed and used to draw hot air through the trays of oxidised leaf in a vertical chamber. This method proved successful.

The present arrangement consists of two vertical chambers, each of which can be sealed from the other. Each chamber can take three trays of leaf, and while one chamber is being charged the drying process continues in the other. Each tray is comprised of a rectangular wooden frame with a fly-wire gauze bottom.

The hot air is provided by an electric heater which can be regulated to high, medium or low. This arrangement dries out the leaf in about 15 minutes. Air volume is controlled at the intake, and the temperature is determined by a thermometer at the entrance to the drying chamber.

Quick drying is the secret of success and the depth of the layer of oxidised leaf on the trays is therefore restricted to half an inch. The spent air is used to preheat the intake chamber, thus maintaining the average drying temperature at about 220 deg. F.

In commercial tea manufacture, the firing conditions may differ appreciably from those at South Johnstone, where only small quantities of tea

were treated and makeshift apparatus used. In large-scale manufacture firing temperatures may range from 160 to 210 deg. F. The best firing temperature for such conditions is about 190 deg. F., about 20 minutes being required for the process.

TEA PRODUCTION AT SOUTH JOHNSTONE.

In 1950, a plucking trial was commenced, the object being to explore the cost of harvesting tea under existing labour conditions in Queensland. It was necessary to determine the black tea equivalent of a given quantity of freshly plucked leaf in order to ascertain the cost of tea harvesting and to find out whether the quality of the tea grown would meet the palate of the Australian tea drinker. Thus the Bureau became involved in the process of manufacture, about which little was known locally at the time.

An outline of the process was obtained from reference books and from a visiting tea planter, but early attempts at manufacture were complete failures. This was due to inexperience and the lack of facilities.

In the early stages, insufficient leaf was harvested to allow of effective rolling. Chopping and bruising, which were substituted for rolling, did not bring about the desired oxidation. In addition, the drying which took place in front of a fan-type electric radiator was far too slow.

Later, when heavier pluckings began to come in, it became necessary to improve the equipment so that the greatly increased quantities of leaf could be handled.

Plate 7.

Tea Harvesting Partly Mechanised. This outfit comprises a portable motor and generator, a cable reel and an electrically driven leaf cutter. The power plant is capable of operating four cutting units. The cables unwind as the operators increase their distance from the power plant.

It is of interest to note that yields at South Johnstone have been maintained at approximately 1,000 lb. of commercial tea per acre per annum. Brief notes on the improvisations made have been included in the previous section dealing with tea manufacture.

Figures obtained in 1951 from the first year's operations showed that it cost 7s. to harvest enough green leaf to make 1 lb. of commercial tea. This was based on a plucking standard of "a bud and three leaves." Trial manufacture, undertaken to determine such costs, afforded an opportunity for checking quality also. Samples of each batch were forwarded to tea merchants for testing.

The quality of the tea produced was quite good, but the cost of hand harvesting by semi-skilled Australian labour was very high. Greater picking skill would no doubt have reduced this cost appreciably, but it was very evident that some form of mechanical harvesting would have to be developed if tea was to become a payable crop under North Queensland conditions.

MECHANICAL HARVESTING.

The problem of harvesting costs had also arisen, if to a lesser degree, in established tea growing countries. The matter had therefore been under investigation for some time.

As a result of exploratory work which was commenced in England soon after World War II, a small mechanical harvester modified from an electric hedge clipper was developed. It consisted of a portable 110 volt generator working four hand-held leaf-cutting units, the power for which was conveyed by portable cables (Plates 7-9).

Plate 8.

Tea Harvesting Partly Mechanised. An individual cutting unit is here up-ended to show gauze container on top, cutter-bar and reel at bottom, and electric motor and carrying handles on right.

Plate 9.

Tea Harvesting Partly Mechanised. This shows a single cutting unit in action. As it is passed over the top of the "table", the cutter-bar cuts the "flush" and the reel sweeps the leaf into the container.

One of these units was procured for the Bureau, and an experiment to compare the cost of hand harvesting and mechanical harvesting was initiated in February, 1951. In this trial, mechanical harvesting cost about half as much as hand harvesting—5s. 8d. as against 12s. 2d. for each 1 lb. of commercial tea.

It will be seen that the cost of hand harvesting had appreciably increased on the previous year's figures. This increase was brought about partly by an increase in wages and more particularly by an alteration in the plucking standard. The new standard was "tip and two leaves plus the third leaf" as against "tip and three leaves" the previous year. The advantage of the former method has already been outlined.

It was clear from this experiment that the partly mechanised harvesting method had not reduced costs to a level which the trade could bear at present. The main reason for this was that, even with the degree of mechanisation afforded, the output per person was still much too low.

However, two important points have emerged from the trial:—

(1) Tea can be harvested mechanically.

(2) This method of harvesting does not greatly impair quality.

The behaviour of tea bushes subjected to many years of mechanical harvesting cannot be foreseen, but so far there have been no ill effects.

The quality of North Queensland tea generally has exceeded expectations. Trade tests have indicated that the samples from South Johnstone have compared favourably with the better lines of imported lowland tea. When hand-harvested and machine-harvested samples were directly compared there was generally very little to choose between the tea-taster's estimation of the two batches.

The following comparison is a typical one, taken from reports provided by commercial tea-tasters:—

Sample No. 39, *hand harvested* (*May* 1953): Neat leaf; a little tip; bright, hard, grippy, pungent; touch of flavour. Good sample.

Sample No. 39, *machine harvested* (*May* 1953): Neat reddish leaf, a little tip; fair colour and strength; bright, grippy, pungent. Good sample.

While many of the terms used belong to the jargon of tea tasting and will only be fully understood by those in the trade, comparisons such as this support the claim that mechanical harvesting and lowered quality standards need not necessarily go together.

MODIFICATIONS FOR MECHANICAL HARVESTING.

The machine now in use is not the complete answer to rising harvesting costs but it has opened the way for

Plate 10.

Hedge Plantings of Tea in Early Stages. These hedges had recently been planted out (early 1952). Beds are of varying width, that in the left-centre position being a 5-row hedge. The bed on the far left was mulched with rice straw, and some shade-tree plants are being established in the spaces between hedges.

further studies. To increase the output per man, the width of cut must be increased well beyond the weight-carrying capacity of a man. This involves the use of a mounted machine. Ideally, a large machine would be self-propelled and operated by one man.

The cutter-bar would require to be precision-set for height, and therefore independent of ground-surface irregularities. In addition, the harvester bar would require to be replaceable by a stouter bar for top-pruning when necessary. A machine like this could operate properly only on hedges of tea separated by narrow, firm tracks for its wheels. Some interest has already been expressed in developing a harvesting machine of this type, but so far without result.

Hedges of various widths, employing different plant spacings, have been established at the Station at South Johnstone. These have made rapid growth and it now seems possible that a garden laid down in this manner would come into production at least two years earlier than a normal garden.

Spaces between hedges are being sown to a low leguminous cover crop such as is provided by *Desmodium heterophyllum*. This cover should assist in erosion control, reduce weed growth and help promote soil fertility.

How the tea plants will behave under this cultural method is unknown, but there is some evidence that tea bushes do not require all the space that has been allowed in the past.

It is considered that some form of permanent-way between hedges, to enable precision setting of the harvester, might well be essential. Light railway lines or narrow concrete strips could be considered for this purpose. Although such a system would involve a high capital expenditure per acre, the lengthy production life of tea gardens (60-80 years under good conditions) would offset this cost to a very considerable extent.

FUTURE PROGRESS.

Future progress is largely dependent upon—

(1) the successful development of the hedge plantings, and

(2) the provision of effective "auto-harvesters".

Investigations are necessary to show whether hedge plantings can equal in yield, or outyield, the old standard tea gardens. At the same time information is required on such important factors as (1) optimum width of hedge, (2) most suitable plant spacings within the hedges, (3) most suitable spacings between hedges, (4) any necessary alteration to fertilizer applications, and (5) any new problems of cultivation or management. Finally, further information is needed on the need for shade trees in such plantings and on the best means or arrangement so that they will not interfere with the operation of mechanical harvesters.

A number of these problems are now being studied at South Johnstone, and further reports will be made as useful results come to hand.

POULTRY FARMING.

Fowls recorded on rural holdings in Queensland at Mar. 31, 1956, numbered 1,409,226, of which 787,159 were held by 845 commercial poultry farmers. Egg production totalled 9,278,000 dozen, and of this total 6,546,000 dozen (71 per cent.) were from commercial poultry farms.

Diseases of the Pineapple

By B. L. OXENHAM, Pathologist, Science Branch.

The diseases of the pineapple are comparatively few compared with those affecting many other fruit. However, there are some serious troubles which have to be taken into consideration if successful production is to be achieved.

Fortunately, most of these can be adequately controlled by taking preventive measures both before and after establishing the crop. It is therefore essential to plan well in advance so that the methods of disease prevention can be incorporated in the general system of crop culture.

DISEASES OF STEM AND LEAF.

TOP ROT.

Top rot or heart rot usually affects the pineapple plant before it flowers, although sometimes fruiting plants or suckers on ratoon plants may be infected.

The early symptoms consist of a change in colour of the heart leaves to a yellow or light-brown tinged with red. They become flabby and recurved along the edges and are easily pulled from the plant.

Internally, the soft stem and leaf bases towards the apex of the plant are found to be rotted. Here the tissue is watersoaked at first, later becoming yellowish-brown with a darker line between healthy and diseased areas. The whole heart of the plant eventually exhibits an evil-smelling soft rot.

The older fibrous tissues of the butt are rarely invaded and suckers often arise from the dormant buds. These may also be affected, but in any case they are weak if the mother plant was small at the time of attack.

Older plants may develop stem lesions which do not develop to the

Plate 1.

Top Rot. A recent planting of pineapple tops affected by top rot.

top rot phase. The plants are stunted, and leaves arising from the affected areas are narrow and stiff.

Top rot is caused by two species of fungi, the most common of which (*Phytophthora cinnamomi* Rands) affects the plants in the autumn and winter. The other (*Phytophthora parasitica* Dastur) has caused infections in the spring and early summer in South Queensland and is the chief cause of the disease in northern areas.

These fungi are soil inhabitants and form spores in moisture in the heart of the plant or in the soil. The spores are transported in surface water and are responsible for the spread of the disease.

Plate 2.

Top Rot. A section through the base of a young plant affected with top rot.

Plate 3.

Top Rot Control. A pineapple planting on contoured beds. Note the drain between beds.

Root rotting caused by *P. cinnamomi* may extend through the stem of small plants and result in top rot, but in larger plants the infection takes place directly in the stem apex or leaf bases.

The fungi causing the disease reach the plant in runoff water, soil wash or the splash of rain. The most serious losses occur following heavy rains, particularly in autumn-planted tops.

Young plants grown from tops or small slips are more susceptible than those propagated from suckers, because their open structure and small stature allow easy entry of spores in soil or water. In larger plants several weeks may elapse between infection and the appearance of symptoms.

Top rot is most serious on flat or poorly-drained land. It may affect tops even on reasonably well-drained soil types if heavy rain falls soon after planting.

Control.

Top rot may be prevented by avoiding those conditions most suitable for its development.

Drainage systems should be designed to intercept outside water before it reaches the plantation. Within the area, the water should be diverted into inter-row drains and carried away quickly. It should not be allowed to flow across the rows. If the land is flat, or the soil shallow, planting on

beds with subsequent hilling is advisable. If hard-pan is present, the subsoil should be broken up by ripping.

The improvement of soil structure by good cultural methods allows quicker absorption of moisture and less runoff.

When planting tops it is advisable to level the land carefully and slightly bed up the rows, even on sloping sites, so that temporary puddling does not take place in small depressions. Excessively deep planting should be avoided, and soil should not be allowed to enter the hearts during planting.

Plants affected by top rot should be removed and replaced by the largest planting material available, after bedding-up the gaps in the rows. The replants may be dipped in strong Bordeaux mixture (7:7:20) to protect them against subsequent infection. Some burning will result, but this does not affect the subsequent growth of large plants.

BASE ROT.

Base rot usually occurs soon after planting and is most prevalent in the warmer months following wet weather. It is typically a black rot of the butt of the plant. The softer tissues are destroyed and only the stringy fibres remain. Decay of the butt is followed by wilting of the foliage, and the plants may be readily broken off at ground level.

Plate 4.

Base Rot. Internal and external symptoms of an affected sucker.

The disease is caused by the same organism (*Thielaviopsis paradoxa* (De Seynes) von Hohn) as produces water blister in ripe fruit. This organism is commonly called the "pineapple fungus."

Plate 5.

Base Rot. Section through a severely affected sucker.

It cannot enter the unbroken skin of the plant, and infection takes place through cultivation injuries, or most commonly through the unhealed scar where the planting material has been removed from the plant.

Control.

The observance of the following precautions should ensure against losses from base rot.

The planting material should be upended and cured for at least two or three days in the sun before planting or packing for transport. This curing process should be carried out after the fruitlets are removed from slips or after stripping. Storing the material in heaps must be avoided at all costs.

Very often during prolonged wet weather tops up-ended to cure will still become infected. Dipping of the plants in an organic-mercurial fungicide, or else spraying one of these preparations on the upturned butts, will prevent this trouble.

The usual methods of improving soil drainage and the avoidance of planting in wet periods will also help to reduce losses from base rot.

Plate 6.

Root Rot Wilt. Young plant showing early leaf symptoms.

ROOT ROT WILT.

The term wilt, as applied to pineapples, refers to a type of plant debility which may be due to a variety of causes. Any organism which destroys the roots will produce wilting of the plant. Such organisms include fungi, nematodes and insects.

Root rot wilt is the name given to a disease in which fungal decay of the roots is the primary cause.

The symptoms above ground consist of a change in colour of the leaves from a healthy green through various shades of red, pink and yellow. The outside leaves become limp and the edges curl under, and there is a dying back from the tips. The centre leaves remain fairly upright, while the outer whorls fall to the ground. If fruiting plants are affected, the fruit colours prematurely and is of no commercial value. Slip and sucker growth is retarded.

Foliage symptoms are always preceded by collapse of the root system and affected plants are easily pulled out of the ground. The young roots and softer parts of the older ones rot rapidly, but the root sheath and woody central cylinder adhere to the plant for some time. If the rotting is slow or incomplete, some months elapse before pronounced foliage symptoms appear.

Phytophthora cinnamomi, one of the fungi causing top rot, is also considered to be responsible for most of the root rotting in pineapples. Other less aggresive parasites may do some damage to roots weakened by unfavourable soil conditions or other factors.

P. cinnamomi is prevalent in most soils which have grown pineapples. It may be introduced into virgin land on soil adhering to planting material, and it also attacks some other plants besides pineapples.

The development of root rot wilt is favoured by high soil moisture and it therefore occurs in soils heavy in texture or with poor natural drainage. Waterlogging for only a few days is sufficient to produce root rotting if the organism is present.

Temporary waterlogging is not uncommon in some of our pineapple soils during the wet season, but the most spectacular damage occurs when prolonged rains extend into the winter months. Under these circumstances the soil remains wet for long periods and widespread root damage results.

Control.

The measures recommended for the improvement of soil drainage in connection with top rot control also apply to root rot. The selection of vigorous planting material and cultural measures designed to produce a vigorous root system are also important. A rotation of crops, one of the basic farming principles, is necessary to improve soil conditions and reduce the numbers of harmful organisms present.

Plate 7.

Root Rot Wilt. The effect on bearing plants.

When root rot has occurred in a plantation, some benefit will be found from hilling. This helps the plants to produce new roots higher up the stem and improves drainage. Cutting back the lower leaves before hilling is necessary to allow the soil to be thrown up close to the plants and promote root growth from below the old leaf bases.

WHITE LEAF SPOT.

White leaf spot normally occurs in the autumn during overcast, showery weather. It is a common disease in pineapple plantations but rarely causes economic damage.

The first symptom is a small yellow to brown spot which rapidly elongates under moist conditions and may reach several inches in length. If the leaf is girdled the top portion droops over and withers. Fine weather results in rapid drying of the areas to give straw-coloured, or nearly white, papery lesions. The spotting will be seen to commence where two leaves have rubbed, or where a leaf has been punctured or damaged in some manner.

The organism responsible (*Thielaviopsis paradoxa*) is the "pineapple fungus", which also causes base rot. It enters the leaves through injuries. This factor and the special weather conditions required for development limit the incidence of white leaf spot.

Control.

Control measures are rarely, if ever, required, and experimental work in this direction has not been considered necessary.

DISEASES OF THE FRUIT.

Water Blister.

Each year during the summer harvest water blister causes considerable losses in pineapples consigned to southern markets. It may also occur in cannery fruit if there is some delay between harvesting and processing. The disease is rarely seen on the farm and many growers are not familiar with the symptoms.

Water blister appears as a soft, watery rot of the flesh of the fruit which assumes a darker watersoaked appearance. The skin overlying the decaying flesh is glassy, watersoaked and characteristically brittle. Finally, skin, flesh and core disintegrate. The fruit weeps considerably before collapsing, and the decay is accompanied by a sweetish odour.

The fungus responsible for this rot (*Thielaviopsis paradoxa*) has been mentioned previously in connection with base rot and leafspot. Relatively high temperature and humidity are necessary for water blister development and these conditions often prevail during the months of January to April when the summer crop is being harvested.

During such times it is common for the fungus to be found on the plantation on rotting tops and suckers left lying in heaps in damp situations. On both rotting fruit and leaves there are produced masses of dark spores

Plate 8.

Root Rot Wilt. The effect on ratooned pineapples. Many of the plants have collapsed and others have produced weak suckers.

Plate 9.

White Leaf Spot. Pineapple leaves showing the characteristic white marking.

which impart a grey appearance to the rotting tissue. Infection takes place during picking and packing by spores distributed by wind or rain from such rotting pineapple material lying in the plantation or near the packing shed.

The fungus cannot penetrate the unbroken skin of the fruit, so growth cracks, bruises or freshly cut surfaces provide the sites of entry. There is a lapse of over 48 hours between the time of infection and the appearance of symptoms, so the disease does not usually develop before cannery fruit is processed. It may be well advanced, however, before fresh fruit reaches its destination in the southern States.

Control.

The avoidance of losses due to water blister is quite practical for the careful farmer. Success depends on careful and hygienic picking, handling and packing of the fruit.

The packing shed must be kept clean and all pineapple refuse promptly removed from the vicinity. Planting material should never be kept near the packing shed. At the time of an epidemic, regular disinfection of the packing shed and its surroundings should be carried out by spraying with 2 per cent. formalin solution.

Extreme care should be taken in picking, handling and packing to avoid bruising the fruit. Market fruit should be cut and not snapped from the plant. Sunburnt, damaged fruit, or fruit with an excessive number of growth cracks should be excluded from southern consignments. The packing of wet fruit should be avoided, when possible, and the packed cases kept dry.

Selection of planting material, to eliminate knobby fruit types, will reduce the damage to fruit during packing.

If losses are anticipated it may be an advantage to protect the cut stem of the fruit against water blister. Dusting with 25 per cent. benzoic acid dust has been recommended, but it has been more recently shown that a 1 per cent. sodium salicylanilide solution is effective, is easier to apply, and leaves less residue. The base of the

fruit may be dipped before packing, but only firm fruit should be treated, as any weeping of juice will impair the chemical protection.

FRUITLET CORE ROT.

Fruitlet core rot, also known as "brown spot," appears sporadically in most pineapple districts. The seasonal incidence varies but it is most common in fruit maturing during winter or spring.

It is often not detected until the fruit is cut, but the failure of one or more fruitlets to colour at maturity may be an indication. Some badly affected eyes even become brown and sunken as the fruit ripens. Internal symptoms consist of a browning of the centre of the fruitlets starting below the floral cavity and sometimes extending to the core. The marks are firm and vary in size from a speck to an area involving one or more fruitlets.

Fruitlet core rot is caused by several species of fungi (*Penicillium* spp. and *Fusarium* sp.) which grow on the decaying floral remnants in the cavities under the eyes. They enter the flesh of the fruit through injuries to the hard lining of the

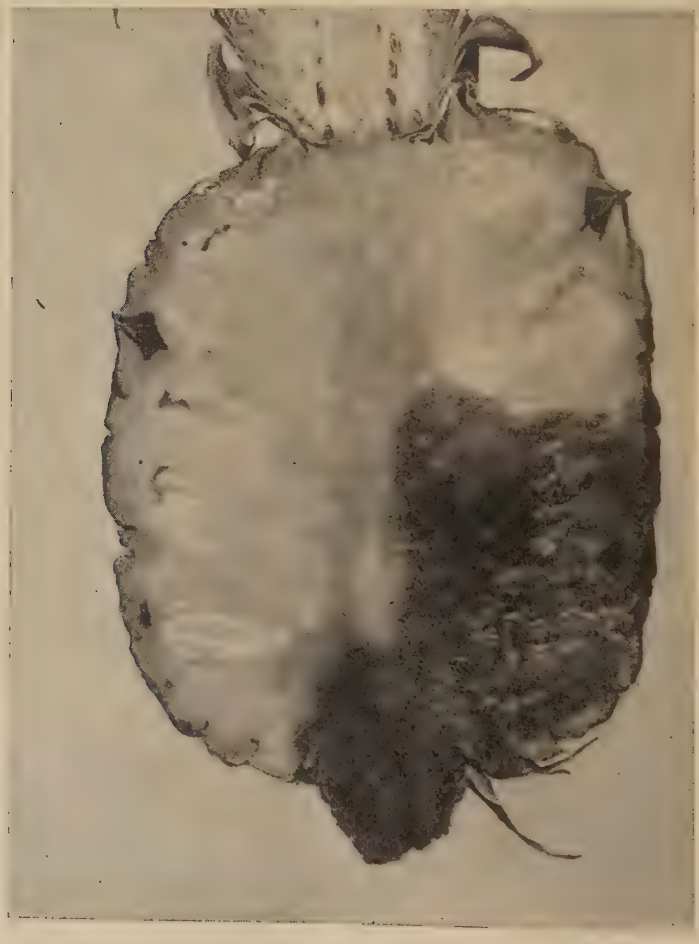

Plate 10.

Water Blister. Fruit showing both stem and side infection.

cavity, and then only as the fruit ripens. Such injuries may be caused by growth cracks, or the feeding of certain insects, such as mealybugs and mites.

Control.

The sporadic nature of fruitlet core rot outbreaks, and the fact that any control measures would have to be aimed at the predisposing factors, present many practical difficulties. Avoiding a winter crop, as recommended in the case of black heart, should also help in escaping fruitlet core rot.

the centre of the fruitlets. Sometimes the discoloration may be yellowish or reddish-brown and continuous areas of the flesh may be affected.

Externally there are no obvious symptoms, although affected fruit often sound hollow when rapped.

Infection is thought to take place at flowering, or shortly afterwards, but the disease develops only during the ripening process. Large fruit seem more susceptible than small fruit, probably because they are generally less acid.

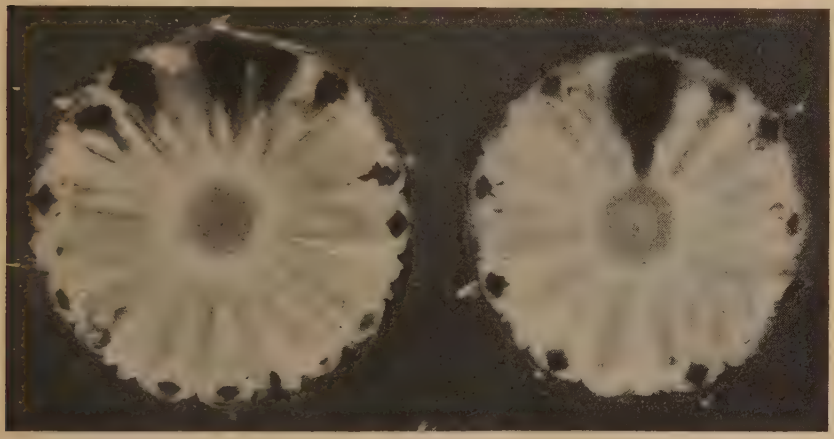

Plate 11.

Fruitlet Core Rot. Section through affected fruit.

MARBLING.

Marbling is a bacterial disease which is most prevalent in fruit of low acidity. For this reason it has been of greatest importance in the warmer pineapple areas of the world, such as Mexico, Haiti and the Philippine Islands, where summer fruit is low in acid and sugar content. It has sporadically occurred in southern Queensland but has only caused economic losses in the far north of the State during the summer crop.

Marbled fruit is characterised by a brown speckling and abnormal hardening of the tissues, particularly in

The Smooth Cayenne is the most susceptible of the varieties grown in Queensland.

Control.

Any control measures for marbling must at present be aimed at reducing the susceptibility of the fruit.

Close spacing of plants to reduce fruit size, and high potash fertilizing to increase fruit acidity, are possible means of reducing the disease. Delaying maturity of the summer crop may also be helpful, as the incidence of marbling decreases as harvesting progresses and the fruit increases in acidity.

Plate 12.

Marbling. As seen in section of fruiit.

YEASTY ROT.

Yeasty rot may affect over-ripe or damaged fruit in the field, but also causes wastage on the southern markets. Like water blister, it is a wound infection, but it needs less humid conditions for development. Therefore, in hot weather it will break down ripe fruit in the plantation, whereas water blister is rarely found under such circumstances.

The first symptom is a bubbling exudation of gas and juice through the crack, sunburn or injury where infection occurred. The skin turns brown and leathery and as the juice escapes the whole fruit becomes spongy.

Internally, the decaying flesh is a bright yellow and is ruptured by large gas cavities. Ultimately, only a mass of fibrous tissue is left in the leathery skin.

Yeasty rot is a fermentation disease and may be caused by various yeasts. In the field it is only important in sunburnt fruit or if growth cracking is prevalent.

Control.

Field control involves the adequate protection of maturing fruit against sunburn. The picking and packing precautions recommended for the control of water blister also apply to yeasty rot.

PINK DISEASE.

Pink disease, like marbling, appears only sporadically in southern Queensland. It cannot be detected before the fruit is cut, and even then the slight pink discoloration, from which it received its name, is not always obvious. However, during cooking or processing a light-brown discoloration develops in the diseased tissues. Affected fruit are therefore useless for canning.

Pink disease is caused by an unidentified bacterium which probably infects the fruit at flowering time. Insects are thought to carry the organism from wild fruits to pineapples.

Control.

No effective control measures can be recommended for pink disease.

SUMMARY OF CONTROL MEASURES.

It is possible to prevent many of the important diseases of pineapples by taking suitable precautions in growing and handling the crop. Such precautionary measures may be incorporated satisfactorily in the cropping programme.

The continuous growing of a single crop is basically an unsound farming practice. It has, however, been

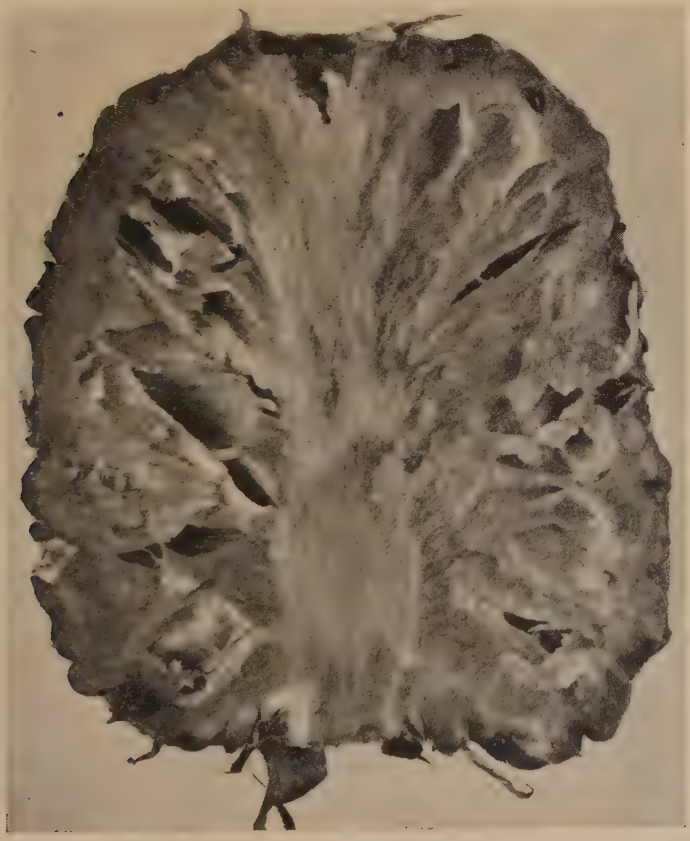

Plate 13.

Yeasty Rot. Cross section showing characteristic cavities.

carried on in some of our older districts which have been growing pineapples for many years. The result is a deterioration in soil structure and fertility, as well as an accumulation of soil organisms harmful to pineapples. A suitable rotation of crops is therefore desirable.

The precautions that should be taken to prevent pineapple diseases may be listed as follows:—

(1) Choose a well-drained, deep soil for pineapple culture.

(2) Rotate crops.

(3) Maintain good soil structure.

(4) Lay out the plantation correctly and provide artificial drainage where necessary.

(5) Select vigorous planting material of good type.

(6) Cure all planting material.

(7) Plant carefully.

(8) Practise plantation and packing shed hygiene.

(9) Prevent sunburn and injury to the fruit.

(10) Harvest, handle and pack the fruit carefully.

RETIREMENT OF Mr. R. VEITCH.

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Mr. R. Veitch, B. Agr. Sc., B.Sc. (For.), F.R.E.S., who was Assistant Under Secretary (Technical) of the Department of Agriculture and Stock, retired from the Public Service on 31st December, 1956.

Mr. Veitch was born in Edinburgh, Scotland, and received his University education at the Edinburgh University where he graduated in 1912. Mr. Veitch acted as Assistant Entomologist to the Imperial Bureau of Entomology, British Museum, London, during 1912-14, and in the latter year was appointed Entomologist to the Colonial Sugar Refining Co., Lautoka, Fiji.

Mr. Veitch joined the Queensland Department of Agriculture and Stock as Chief Entomologist in 1925. In 1936 he was appointed also Director of Research, in 1937, Director of Plant Industry (Research), and with the re-organisation of the Department in 1945, he became Director of the Division of Plant Industry He was appointed to his final position as Assistant Under Secretary (Technical) in 1947.

Mr. Veitch was largely responsible for the initiation of the policy of recruiting highly trained young men from the universities for appointment to the technical staff, thus ensuring a solid foundation for the post-war expansion of the Department.

Dr. W. A. T. Summerville succeeds Mr. Veitch as Assistant Under Secretary (Technical).

Chilling Requirements of the Peach

By T. J. BOWEN, Assistant Horticulturist.

In most deciduous fruits, winter temperatures play an important part in determining the size of the crop in the following season. The peach is no exception to the general rule.

Peach trees do not thrive in localities where winters are severe, for injury to blossom buds may occur when temperatures fall to 27 deg. F., that is, 5 degrees below freezing point. At temperatures of 15 deg. F., nearly all the buds are killed and even the wood may be injured. The varieties, however, differ in their resistance to low winter temperatures.

While the peach does not thrive in very cold climates, a certain amount of winter chilling is required to ensure normal "breaking" of the buds in spring, and the severity of the winter also affects the date of blossoming. Flowering usually takes place during the first spell of warm weather after the flower buds have received sufficient winter chilling for the variety. Following a mild winter in which their chilling requirements are not satisfied, some varieties fail to set fruit after flowering; examples in the Stanthorpe district are Mayflower, High's Early Canada and Brigg's Red May.

Bud Formation.

The buds of deciduous fruit trees enter a rest period shortly after they are formed in the January-March

Plate 1.

Fruit Set in The Peach. The variety is Pullars Cling, a late-maturing type which has not the exacting chilling requirement of the early-maturing Mayflower and Brigg's Red May.

Plate 2.

Mayflower Peach in Bloom. This is one of the problem varieties which is susceptible to bud-shedding after a mild winter.

period, growth being suppressed by a regulating hormone which moves down to the buds from the tips of the shoot. The buds develop scales and embryo leaf and flower parts before they enter the rest period. After the buds have had sufficient chilling in winter, they "break" into shoots and flowers when weather conditions become favourable in spring.

During the rest period, the buds remain inactive and can then withstand moderately low temperatures. The length of the rest period depends on a number of factors, chief among which are the variety, the length of the shoot and the amount of chilling received.

If the tree is exposed to favourable growing conditions in spring before the buds have had sufficient chilling, flowering may be irregular; many blossoms fall before they are fully open, and in some buds the embryo flower parts actually die before the buds open.

Length of Chilling Period.

Most deciduous fruit trees open their buds satisfactorily when they have been subjected to temperatures between 32 deg. F. and 42 deg. F. for a period of about eight weeks. Peaches, however, need less chilling than pome fruits such as the apple, and most varieties "break" normally after experiencing an 8-weeks period with mean temperatures of approximately 50 deg. F.

Weather conditions exert a good deal of influence on the length of the chilling period, for sunlight, fog,

cloud and wind all affect bud temperatures. In the orchard, bud temperatures on a sunny day may be higher than the recorded air temperature, for the buds absorb more heat than they radiate. On the other hand, cloud and wind tend to bring bud temperatures closer to the air temperature.

The length of the chilling period is also affected by the vigour of the tree and soil deficiencies of nitrogen and

Plate 3.

Fruit-bearing Wood in The Mayflower Peach. **A,** Shoot growth at the end of the first growing season; **B,** Shoot growth at the end of the second season after it has borne a crop.

v — vegetative bud; f — flower bud;
l — leaf bud; s — spur;
x — old fruit stalk; t — twig.

water. Buds on vigorous, late-growing shoots require more chilling to break the rest period than do buds on weak shoots. Again, soil deficiencies of nitrogen and water which cause premature leaf fall in autumn usually induce early bud opening after a warm winter.

Varietal Reactions.

Mid-season and late peach varieties normally set satisfactorily following a mild winter in the Granite Belt. Under these conditions, however, early varieties such as Mayflower, High's Early Canada and Brigg's Red May which have an above-average chilling requirement, often shed their buds during late winter or early spring. As a result, the crop is substantially reduced, and if the majority of the flower buds are shed, may be negligible. Leaf growth may also be affected; the trees then lack vigour and, owing to the sparse foliage, limbs and branches are exposed to the risk of sun-scald.

Unlike the foregoing varieties, some such as the China Flat (one of the Oriental Peento peaches) require little chilling; they flower and set fruit following a warm winter. This peculiarity of the China Flat and related varieties makes commercial production practicable in the coastal areas, where better types of peach are of little or no commercial value.

Control of Bud Shedding.

Treatments which break the rest period in deciduous fruit trees have been of interest for many years.

One old-fashioned method of inducing normal bud-burst after a warm winter is associated with the practice of long pruning and consists in making a "nick" close to the bud with the secateurs. This method is, however, not very effective in preventing bud abscission, which is the main problem in early varieties of peach at Stanthorpe.

Better results can be obtained by applying a spray containing 0.03 per cent. DNCHP (dinitro-orthocyclohexylphenol) to the trees about 4 weeks before bud-burst. Treatment effects depend somewhat on the variety and the previous cropping history of the individual tree. Bud shedding is seldom completely suppressed but crop yields are generally increased. Normally, however, DNCHP sprays hasten flowering and, to a lesser extent, leaf burst, and this may be a hazard in areas where early spring frosts are troublesome.

BEEKEEPING STATISTICS.

Statistics of the beekeeping industry show that this industry fluctuates very much from year to year in regard to the number of operating beekeepers, the number of hives held and the quantity of honey produced. The Government Statistician records that during 1955-56 the number of commercial beekeepers, 700, was 77 less than during 1954-55, the number of productive hives, 24,089, was about 1,000 less, and the unproductive hives, 11,350, nearly 2,400 less. The total quantity of honey produced, 2,329,138 lb., was, however, nearly 600,000 lb. greater than during 1954-55, and reached the high average yield of 96.7 lb. of honey per productive hive, compared with 69 lb. the previous season. The quantity of honey produced was the third highest ever recorded for the State.

Hookworm Infestation of Working Dogs

By M. S. STEVENS, Veterinary Officer.

Hookworm infestation has become a serious disease in working dogs in the western areas of the State.

Hookworms will kill a susceptible dog in a few days, so owners of valuable working dogs must be prepared to control this parasite. Dogs that have been born and reared in the country have no acquired resistance to hookworms, and sufficient worms to cause death will build up very rapidly.

Signs of Hookworm.

The usual story is that the dog goes out to work quite readily but by midday he is tired, panting and lagging. His condition becomes progressively worse and he has to be carried home. At this stage the dog does not relish his food or he will not eat at all. In a severe case, if the correct treatment is not given immediately the dog will be dead within a week.

The most important sign of hookworm infestation is anaemia. Look at the small blood vessels on the whites of the eyes and under the eyelids, inside the lips, on the gums and the tongue, and you will see that they are very pale. The heart is beating quickly and breathing is fast and shallow. The ears and feet feel cold to the touch. Stinking, black, tarry droppings and sometimes blood are passed. The dog shows a harsh, dry coat.

In less acute cases, where the dog is resisting the infestation, the signs are lack of stamina with signs of anaemia; general unthriftiness; failure to grow and put on condition; diarrhoea; coughing; dropsical swellings; and perverted appetite with dogs eating sticks, soil and rubbish. The skin on the underside of the body might be marked with many small breaks which are inflamed, discharging thin yellow pus, and very itchy. These areas take weeks to heal. Ordinary skin wounds often fail to heal and become ulcerated.

Life History.

The common hookworm in Queensland is *Ancylostoma caninum*. The worms are ½–¾ in. long and reddish-brown or greyish in colour. They have a large mouth armed with three pairs of large pointed teeth. With these the adult worms attach to the first third of the small intestine of the dog, cat and fox, where they suck blood.

The worms lay many eggs which are passed in the droppings. The eggs hatch on the ground to become larvae. They go through more developmental stages and in about a week are able to infest animals. In this stage, the larvae can withstand heat and cold, but not extreme dryness. The larvae live in the soil and may remain alive for many months under suitable conditions.

Animals are infested by eating larvae on their food or through active penetration by larvae through the skin. In the latter case the larvae enter the blood-stream and are carried to the heart, then into the lungs. There they break into the air passages, crawl up the windpipe and are swallowed. Once in the intestines they grow into adults.

Larvae in the blood-stream of a pregnant bitch may enter the unborn puppies, which are then infested before they are born.

Development to the adult stage from infective larvae takes from four to five weeks.

Ill Effects.

The hookworms may cause ill effects in the infested animal in a number of ways.

Firstly, as they burrow through the skin they may produce an inflammatory condition accompanied by irritation.

Secondly, the larval stages damage the lungs, often severely, during their migration.

Thirdly, the adult worms attach themselves to the lining of the intestines and suck blood. The amount of blood removed by one worm is nearly a cubic centimetre every 24 hours. Thus if a dog picks up 300 worms nearly half a pint of blood is sucked out of his body every 24 hours; and no dog can stand such a loss for long.

Treatment.

If you detect signs of hookworm infestation in your dogs, treat the matter as *urgent*. A delay of 12 hours or even less before obtaining treatment can be fatal.

The drugs commonly used are tetrachlorethylene and n-butyl chloride. Carbon tetrachloride and oil of chenopodium are less commonly given.

Plate 1.

Hookworm (Ancylostoma caninum), slightly enlarged.

If giving tetrachlorethylene, use 1 c.c. for each 10 lb. body weight, the dose to be given in a gelatin capsule and followed two hours later by an ounce of Epsom salts. N-butyl chloride is also given in a gelatin capsule; the dose ranges from 1 c.c. for a body weight of 5 lb. to 5 c.c. for a body weight of 50 lb. or over. Affected dogs should be treated each day for three days.

Piperazine citrate is not effective against hookworms.

An iron tonic such as ferrous sulphate 5 grain emphlets should also be given and an adequate protein diet provided.

Prevention.

Sanitation and hygiene are the keynotes in preventing infestation taking place. Overcrowding and poor feeding should be avoided. Animals should be kept under clean, healthy conditions.

If hookworms are known to be present on the property it is advisable to feed dogs off boards or iron which can be kept free from droppings and can be cleaned.

Droppings should be collected every few days and removed from possible contact with the dogs. Buried larvae can penetrate several inches of soil, so reasonably deep burial of faeces is necessary. If dogs are run together in pens the periodical collection of droppings is most important.

Pens with wooden or concrete floors are the easiest to keep clean and provide the safest housing for dogs.

Soaking the soil with saturated (very strong) brine will kill larvae. It should be applied at the rate of 1 gallon per 10 square feet.

These control measures may seem to be a lot of trouble for dogs, which on most properties are kept under very bad conditions and given a minimum of attention. However, when a useful dog is lost his working capacity is sorely missed.

So prevent hookworm infestation as far as you can. Give your dogs a little more attention with regard to their health and well-being.

PESTS AND DISEASES HANDBOOK.

★

The Department of Agriculture and Stock now has available for sale the second edition of Volume III. of the "Queensland Agricultural and Pastoral Handbook," the first edition of which appeared in 1938.

Following a general description of the structure of insects, fungi and bacteria, and a chapter on insecticides and fungicides, the book proceeds with a discussion of the pests and diseases which affect most of the farm and orchard crops grown in Queensland. The insects, fungi and bacteria concerned are described and illustrated, the symptoms of injury detailed, and control measures given.

Among the crops treated are deciduous fruits, citrus, banana, pineapple, papaw and other subtropical fruits, cereals, cotton, tobacco, lucerne, potato, tomato, vegetables, and pastures. There is also a chapter on pests of stored products.

The book runs to 560 pages and contains more than 300 illustrations. It is available to primary producers in Queensland for ten shillings, post free, and to others for one pound, post free.

CAPITAL EXPENDITURE ON QUEENSLAND DAIRY FARMS.

A review of capital expenditure on 54 Queensland dairy farms selected at random was published recently by Messrs. D. B. Williams and F. H. Bollman in the "Quarterly Review of Agricultural Economics".

The average capital expenditure per farm on farm assets over five years fluctuated from the low level of £461 in 1951-52 to £654 in 1954-55.

Excepting motor vehicles, the major items of expenditure were tractors and farm machinery, which reached the record of £294 in 1954-55. The expenditure on these items has gradually increased, while purchases of motor vehicles has settled down at a lower rate for the last three years, though still accounting for 22 per cent. of the expenditure on farm assets in 1954-55.

Expenditure on livestock has been relatively constant over the years, except for purchases in 1951-52 and 1952-53 to build up numbers. In 1954-55 the average for farm livestock was £106.

Expenditure on basic land improvements and farm structures has increased significantly. The value of the additions to land improvement (principally clearing), water supplies, fencing and buildings in 1950-51 was £34; this amount increased to £60, £66, £112 and £107 in each succeeding year.

Expenditure on farm machinery was £68 in 1950-51, £176 in 1952-53 and £140 in 1954-55. Within the five years the 54 farmers bought 31 tractors and 73 new tillage implements.

The report points out that the bulk of the funds spent on farm assets were financed from the farmers' own savings. Higher gross revenue from dairy products in 1955-56 suggests that the flow of savings for investment has been maintained. But the tightening of bank credit evident on the survey farms in 1954-55 continued during 1955-56. Bank loans to farmers in Queensland classified as "mostly dairying and pig raising" fell from £18.4 million in December 1954 to £15.7 million in June 1956.

The authors remark that a continuation of credit stringency cannot but have a severe impact on farms which are unable to accumulate savings to finance land development from current earnings. Among these are farms with an economic potential which will remain undeveloped if adequate credit supplies are not available.

On Durham Downs Station, South-western Queensland.

Tubular Steel Cattle Feeding Stalls

By L. T. FOSSEY, Dairy Officer.

Fodder conservation is becoming of increasing importance to the dairying industry of Queensland.

In the past the most common type of conserved fodder was hay. Today silage is assuming greater importance.

To facilitate handling of these supplementary feeds it is extremely useful to have special feeding stalls. This ensures that each animal receives her due ration, it enables animals to be fed according to their individual production, and it reduces fodder wastage to a minimum.

A very satisfactory layout of stalls has been erected on the property of Messrs. Greiss and Lohmann, of The Caves area, in the Rockhampton district. These stalls are used in conjunction with the feeding of silage from two 90-ton silos. They include individual stalls for each animal, a special feeding trough, and a central alleyway for the handling of the silage.

Construction of Stalls.

These feed stalls were constructed during 1954. They are made of concrete and tubular steel, which was discarded condenser coils from commercial refrigeration plants. These condenser coils were lengths of 1½ in. piping curved to form a series of parallel pipes 14 in. apart.

The coil was cut into lengths of 7 ft. 6 in. and used as the division between the stalls. A 3 ft. length of straight piping was welded onto the curved end of each division to act as a leg.

The overall construction embraces 58 stalls. Each stall is 2 ft. wide and 7 ft. 6 in. deep. The floor is concrete and effectively drained by a drain 18 in. wide set immediately behind the stalls. Behind the drain is a concrete apron extension 5 ft. wide. This apron assists to keep the stalls clean and is particularly valuable in wet weather. The fall in the width of the stalls is 2 in. in 10 ft., and a fall of 4 in. in 7 ft. 6 in. has been provided in the length of the stalls. The overall fall in the level of the floor follows the natural slope, which is towards the silos.

Building Feed Troughs.

The feed troughs are of reinforced concrete. They are formed by setting concrete slabs into a special moulded concrete stand. All the concrete slabs are 6 ft. 9 in. long and 2 in. thick. The reinforcement used was discarded meshed wire crates, which are often used for protection of imported goods. The overall dimensions of these formed troughs are 2 ft. high in the front, 3 ft. 6 in. high at the rear, 15 in. wide at the top, and sloping to 10 in. at the bottom.

Details of this combined trough are shown in Plate 3.

(*a*) Slab A is 10 in. wide and fits in the front of the stand.

(*b*) Slab B is 10 in. wide and is bevelled on both sides so as to hold the other slabs in position.

(*c*) Slab C is 2 ft. wide and is fitted in the back of the stand.
supports the trough. There are 17

(*d*) Slab D is the stand which of these to each set of stalls. The stand is moulded concrete 21 in. wide, 4 in. thick. The front leg is 18 in. high whilst the back leg is 24 in.

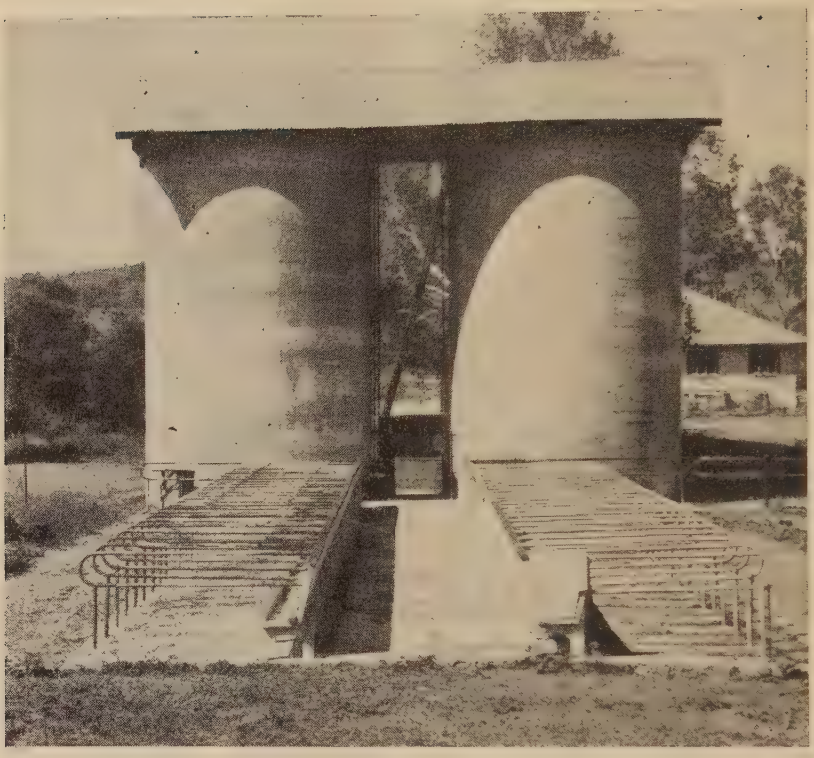

Plate 1.
View of Feeding Stalls and Silos.

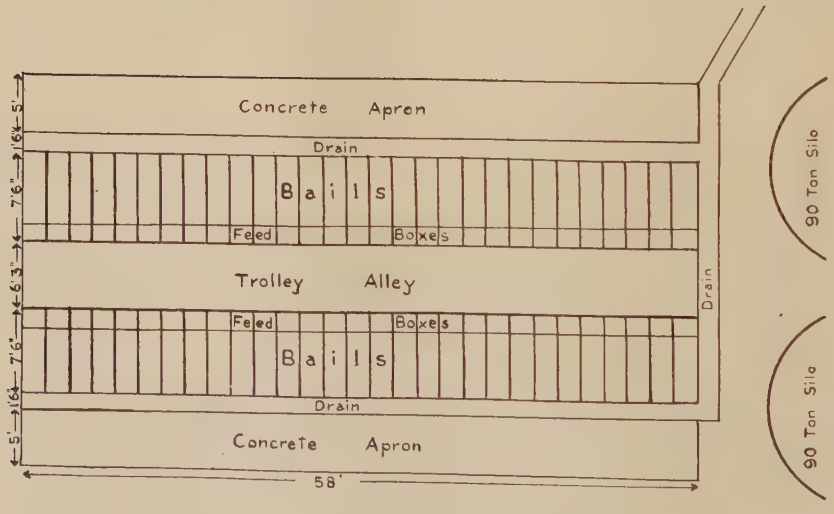

Plate 2.
Layout of Feeding Stalls.

Although the troughs are not fastened to the floor there is no movement. This can be attributed to the weight of the trough and the support given by the bail divisions, which are fixed to the back slab. The top rail of the division is held fast with a length of 3 x 2 hardwood which is fixed to the back slab. This slab also prevents the trough being broken with the shovel when feeding out fodder.

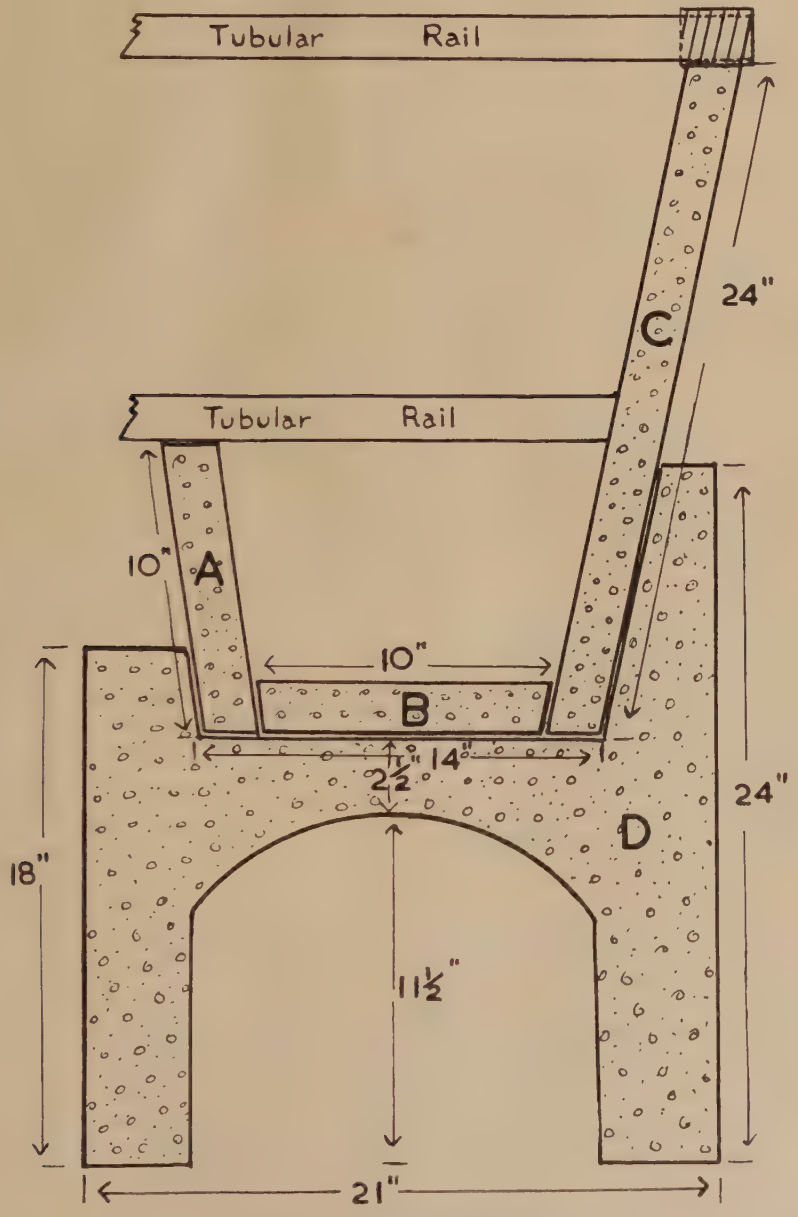

Plate 3.

Details of Trough Construction.

It has been found necessary to place a partition between the cows' heads to prevent disturbances during feeding. The partitions are 2 ft. 6 in. long and 1 ft. 6 in. high. They are placed on the top of the trough and fastened to the division rails with wire clips. The material used was 3 in. mesh, which was also used for reinforcing the floors.

Back chains are available but are rarely used.

Feeding.

The silage is conveyed to the feed boxes along an alleyway 6 ft. 3 in. wide in a wooden trolley. The trolley is 6 ft. long, 3 ft. wide and 2 ft. deep. For easy moving the trolley is equipped with four ball-bearing mounted wheels 4 in. in diameter. Fodder is shovelled into each stall.

Improvements.

The only improvement considered necessary in this construction is an increase in the height of the back slab of concrete of the trough (Slab C). With the present units, stock throw some feed over the back. With this increase the slope of this stand would have to be altered (that is, the bevel on Slab B). Unless this is done the slope could be too severe and result in the slab fracturing.

Adequate drainage should be given serious consideration. Unless efficient drainage is possible, the floor level of the stalls should not be sloped towards the storage silos.

Costs.

These feed stalls are quite elaborate and give the appearance of being very expensive. However, Messrs. Greiss and Lohmann claim the total cost, of these 58 stalls, excluding labour, was £190. The following is how the costs were incurred:—

	£	s.	d.
6½ tons cement	98	14	9
Cartage of cement from Rockhampton to The Caves	6	10	0
30 cubic yards of gravel and sand	26	10	0
Steel mesh reinforcement (second-hand)	20	0	0
1,700 ft. of 1½ in. tubular steel (condensor coil)	7	1	8
240 ft. of 3 x 2 hardwood	7	10	0
9 doz. 6 in. x 5/16 in. bolts @ 3/7 doz.	1	12	3
10 gall. petrol @ 3/10 per gall.	1	18	4
1 gall oil.	0	9	6
1 gall. paint	3	0	0
Welding tubular steel	17	10	0
	£190	16	6

The time required to build, 22 days (8 hours) for 2 men.

HOW FAR WOULD THIS GO?

The total amount of ensilage made in 1955-56 was 36,191 tons, and stocks at the end of March 1956 totalled 43,155 tons.

Hay and chaff held on farms at the end of March amounted to less than 150,000 tons.

Stock numbers at this time were—sheep, 22,115,746; beef cattle, 5,946,282; dairy cattle, 1,383,739.

The Value of Continuous Herd Recording

By S. E. PEGG, Chief Adviser, Herd Recording.

One frequently hears one or more of the following questions and statements from farmers:—

"Is there anything to be gained by herd recording?"

"I have tested all my cows for two years. I know what they give. Why should I continue to test?"

"I have recorded my herd for a few years and am withdrawing from the Herd Recording Group until a batch of heifers by the new bull comes into production."

On the surface some of these statements may appear to be logical, but on closer examination they prove to be unsound.

The general conception of herd recording and its uses appears to be that it is limited to the finding and culling of low producers. This is the first and most elementary and necessary use to which herd recording results can be applied, but the astute farmer takes advantage of herd recording by using it as the basis of all his farm programmes.

These include—

(1) Selection of animals for breeding replacements.

(2) Proving the herd sire.

(3) Feeding according to production.

(4) Seasonal calving.

(5) Suitability of crops.

(6) Pasture planting, renovation, and management.

Herd recording is the yardstick by which all of these are measured, and in order to ensure success it is necessary to keep recording continuously.

The advantage to be gained by continuous recording is shown by a survey of the herds recorded during the 1954-55 herd-recording year. During this year there were 981 herds in which cows completed recorded lactations. It was found that the average production of herds varied according to the number of years the herds had been recorded.

The average production for all cows was 151 lb. butterfat. The average production of cows in herds recorded for one year only was 140 lb., but in herds recorded for seven years it was 182 lb. butterfat.

Details are shown in Table 1.

TABLE 1.

VALUE OF CONTINUOUS HERD RECORDING.

No. of Years Herds Have Been Recorded.	No. of Herds.	No. of Groups.	No. of Cows.	Average Production.		
				Milk.	Butterfat	Commercial. Butter.
				lb.	lb.	lb.
7	45	21	2,345	4,244	182	222
6	31	17	1,742	4,023	169	206
5	54	24	2,634	3,668	160	195
4	83	30	3,921	3,563	151	184
3	120	38	5,118	3,610	157	191
2	261	50	10,439	3,475	150	183
1	387	56	14,510	3,427	140	171
Total ..	981	..	40,709	3,563	151	184

Thus cows in the herds recorded continuously for seven years averaged 42 lb. butterfat more than cows in the herds which had been recorded for one year only. This is equivalent to 51 lb. commercial butter, which at 3s. 6d. per lb. is worth £8 18s. 6d. This extra return per cow is certainly worth while.

There is no doubt that the owners of the herds which have been recorded continuously for seven years have applied the information gained by recording to improve their farm programmes.

I think that from this you will agree that herd recording, and particularly continuous herd recording, pays dividends.

Now what about the man who records his herd for a year or two, ceases for a couple of years, and then again records?

The New Zealand Dairy Board's report for 1954-55 includes the result of a survey of this aspect of recording.

This survey shows that herds recorded for the first time in 1949-50 and recorded continuously until 1952-53 had shown an increased average production of 13 lb. butterfat. Herds recorded for the first time in 1949-50 and not recorded again until 1952-53 showed an increased average production of only 1 lb. Herds recorded for the first time in 1950-51 and not recorded again until 1952-53 also showed an increase of only 1 lb.

These results show that the advantages gained through recording are quickly lost if recording is discontinued.

I think you will agree that the difference of 12 lb. butterfat between the continuously recorded herds and those recorded spasmodically would pay for the cost of recording and still leave a handsome profit—12 lb. butterfat is equal to 14½ lb. commercial butter, which at 3s. 6d. per lb. amounts to £2 10s. 9d. per cow; recording fee at 8s. 6d. per cow leaves a margin of £2 2s. 3d.

The foregoing shows convincingly that continuous recording definitely pays and the increased production attained demonstrates forcibly what can be achieved by planning the farm programme according to the information supplied by herd recording.

LOWER RATES FOR BRIGALOW SPRAYING.

Under certain conditions, the cost of spraying brigalow can be substantially reduced by using less hormone in the spray, the Minister for Agriculture and Stock (Hon. H. H. Collins, M.L.A.) said recently.

Until now, the recommended rate has been 1 lb. per acre. After nearly six years' work with aerial spraying under the supervision of the Government Botanist (Mr. S. L. Everist), it is now clear that some brigalow can be brought under control by aerial spraying with 2,4,5-T in oil at rates of ½ lb. per acre, and in some cases even less. This should bring the cost of brigalow spraying down below £2 per acre.

The chances of success with lower rates depend on the type of brigalow and the thoroughness of the spraying. Excellent results have been obtained on tall virgin brigalow, but on low, shrubby growth, top kill has generally not been as good and is less reliable.

In scrub with undergrowth brigalow, the smaller bushes often receive only a few drops of spray, so that they are less affected by weak hormone solutions than by strong ones. For this reason it is better to use stronger solutions on dense bushy brigalow.

For treating big, virgin brigalow scrub, the low rates can be recommended with confidence, provided spraying is accurately done. But if scrub with much undergrowth or sucker regrowth is to be treated, the advice of the Department should be sought before farmers or graziers commit themselves to the expenditure involved.

The Occurrence and Control of Worm Parasites of Sheep in Queensland

Prepared by Dr. G. R. MOULE, Director of Sheep Husbandry, in collaboration with officers of the C.S.I.R.O. McMaster Laboratory, and the Department of Agriculture and Stock and Woolgrowers in Queensland.

(*Continued from page 698 of the December issue.*)

Worms and the Weather.

The weather controls worm parasites of sheep in Queensland. However, everyone knows that rainfall in the sheep country is extremely variable. Average rainfall figures do not mean very much; in some years more than twice the usual amount of rain falls, in others less than half. This raises two questions:—

(1) How does a wet season bring worms?

(2) Where do the worms go in dry times?

The answer to the first question is related closely to the life cycle of the worms that affect sheep. During warm, moist weather worms' eggs hatch quickly and many of the immature worms survive until they are swallowed by sheep. It is as well, therefore, to examine your rainfall records closely. On the Darling Downs, in the Maranoa and in the Central Highlands, the weather, in an average year, may be conducive to increases in worm infestation. The total amount of rain that falls in a year is not the only thing to consider. The way the rain falls and the number of dull, cloudy days are also important.

In those parts of pastoral Queensland west of the 20-inch rainfall line, the weather may be quite suitable for worms in some years. Dull, cloudy days usually accompany prolonged summer rains. Records show that in years gone by up to 40 inches of rain have fallen between New Year and Easter in districts that usually receive only 16–18 inches of rain a year. In other years the rain has not been so heavy, but cloudy weather with light falls of rain has been much more common than usual. This is the type of weather that suits worms and that is the reason why the barber's pole worm sometimes occurs in the far west, which is usually worm-free.

The building up of heavy infestations depends also on the rate of stocking. The lighter the stocking the smaller the chances of a sheep picking up worm larvae.

In the far west, weather conditions and the low rate of stocking usually combine to keep the worm burdens down. The effects of exposure on eggs and larvae explain differences in the occurrence of worm infestation between open downs country and scrub country.

Overcrowding of sheep is likely to result in a building up of infestations. In the areas of low stocking, overcrowding is generally of a local nature—for example, sheep crowding on areas of fresh feed on frontages, in gilgais and on watercourses, or round water places. Any situation which is overcrowded and thereby heavily contaminated with droppings and the accompanying worm eggs is a "danger area." When a "danger area" is protected by shade or by being located in a lowlying place, the worm

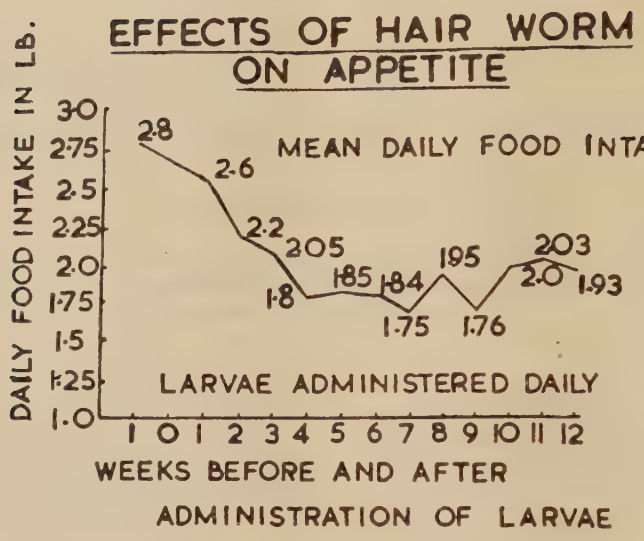

Plate 2.

Diagram Illustrating Effects of Hair Worm on Appetite.—The daily food intake by sheep, in pounds per head per day, is shown on the vertical scale on the left and time on the horizontal scale at the bottom. The amount of food the sheep were eating per week was measured and they were then drenched with hair worm larvae at the point indicated 0 on the horizontal scale.

The irregular line shows the way the average daily food intake of each sheep decreased to as low as 1.75 (= 1¾ lb.) of food seven weeks after the sheep were infested with hair worm. The most rapid decrease in appetite occurred during the first four weeks after infestation.

eggs and larvae will find conditions suitable for development and survival. The high rate of stocking on the area will lead to building up of the worm burden of the sheep. This may be increased by the occurrence of dull, cloudy weather favourable to worms.

Recognition of these two important features—

(1) *Prolonged "wet" seasons, and*

(2) *Local overcrowding—*

will enable the application of appropriate control measures in good time before the worms have caused trouble.

Where do worms go in dry times? Without moisture and shelter the eggs and larvae on the ground soon die, but the worms in the sheep live on for months, even for a year or more, and they keep on laying eggs. The sheep is thus the reservoir of infection.

In regions that have suffered severe drought the sheep that survive will be in very low condition. They will have practically no resistance to worm infestation. If good drought-breaking rains occur and feed begins to grow quickly, the sheep will recover quickly and will soon overcome any worms they may be carrying. However, if the rains are not sufficient to bring a rapid growth of good feed, the sheep will not recover quickly and may not resist worms picked up as a result of the wet weather.

Even under drought conditions there are certain places that may be dangerous from the point of view of worm infestation. Any place where sheep are crowded together, and that provides shelter and moisture for worm eggs and larvae, is dangerous.

Plate 3.

Showing Approximate Distribution of the Nodule Worm in Eastern Australia.

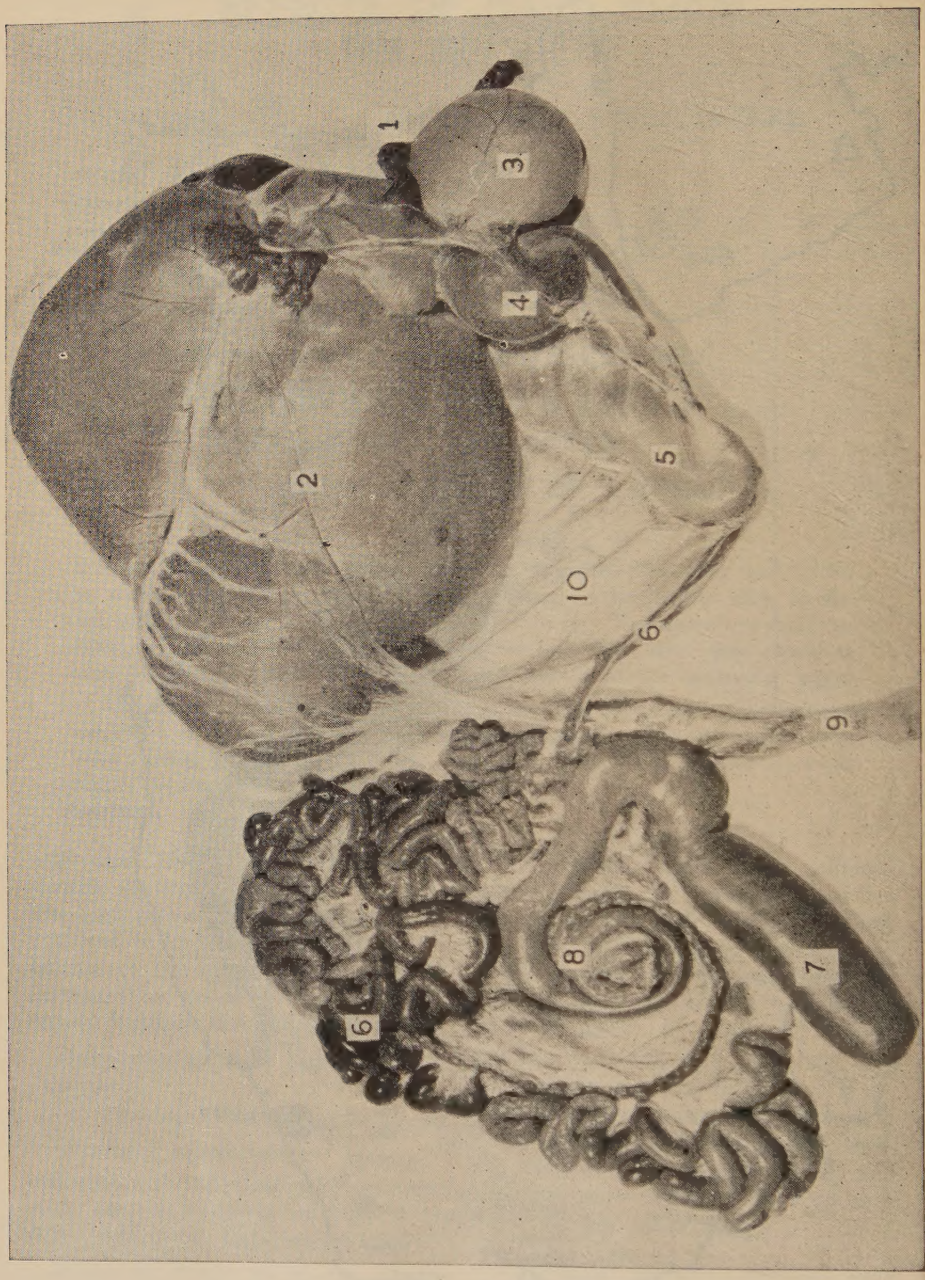

Plate 4.

Appearance of the Digestive Tract of the Sheep and Location of the Various Work Parasites. (For explanation see page 45.)

Watering places, feeding grounds (if sheep are being fed on the ground), feeding troughs and camps may all have actual or potential danger spots.

Board troughs with earth bottoms can be very dangerous, but if they are situated in open sunlight probably very few larvae will develop in the droppings. When bag troughs sag and contact the ground, droppings can bank up underneath in a sheltered situation that may permit larvae to develop. Such young worms could then crawl through the sacking into the feed. These sites can be even more dangerous if heavy dews moisten them.

Feeding grounds are especially dangerous when rain comes. It is wise to move the sheep to a new spot after any fall of rain sufficient to wet the soil for an inch or so.

In drought time, when feed is short, sheep will have lower resistance to the effects of worms. A degree of infestation which in normal times would not be of much consequence may in drought time be very serious. It is therefore a wise precaution to drench sheep as soon as it is evident that they are losing condition because of a shortage of feed.

Important Weather Conditions in the West.

Dryness, with heat or cold, destroys eggs and larvae on pastures. Therefore sheep in western Queensland are unlikely to build up heavy infestations during dry periods, except under special circumstances. Don't forget, however, that sheep may carry over an infestation into a dry period. If dry weather prevails for several months and feed is becoming scarce, it is advisable to drench. By removing the worms picked up before the dry spell the sheep will have a better chance to thrive.

The ability of hair worm eggs and larvae to withstand long periods of cold dry weather during the winter may lead to accumulative contamination of the pastures. These eggs hatch rapidly and sheep may be quickly infested. A short dry period of several weeks during winter months, followed by rain, should always be

DESCRIPTION OF PLATE 4.

Region of Tract.	Parasites Found.
1. Gullet (oesophagus)	..
2. Paunch or 1st Stomach (rumen) ..	..
3. Honeycomb or 2nd Stomach (reticulum)	..
4. Bible or 3rd Stomach (omasum) ..	..
5. Rennet or 4th Stomach (abomasum)	(*a*) Large Stomach Worm or Barber's Pole Worm (*Haemonchus*) (*b*) Small Brown Stomach Worm (*Ostertagia*)
6. Small Intestine or Runners	(*a*) Small Intestinal Worm or Black Scour Worm (*Trichostrongylus*) (*b*) Tapeworm
7. Blind Gut (caecum)	(*a*) Whipworm (*Trichuris*)
8. Crown (colon)	(*a*) Nodule Worm (*Oesophagostomum columbianum*)
9. Hind or Back Gut (rectum)	..
10. Caul (omentum)	Tapeworm Cysts (*Cysticercus tenuicollis*)

regarded as a danger period for hair worm infestation. This is especially so if previous worm troubles have been encountered.

Spring and summer rains followed by humid, warm, dull weather should always be regarded as a danger period for barber's pole and nodule worm infestation. Drenching should be carried out about three weeks after rain before the worms or the contamination of the pasture reaches dangerous levels.

KNOW THE PARASITE—ACT ACCORDINGLY.

The strategic drenching plan illustrated in Plate 1 is based on actual observations of the seasonal changes in the worm burden. It is an attempt to relieve the grazier from worrying whether his sheep are infested, and, if so, with which species of worms.

However, there will be occasions when a grazier wishes to know what the worm burden of his sheep may be.

The days when sheep were treated for "worms" should long be past. Different kinds of worms produce different diseases at different times of the year and require different drugs for treatment. In other words, a correct diagnosis is essential.

Diagnosis may be based in one or more of the following:—

(1) Recognition of symptoms.

(2) Examination of droppings.

(3) Post-mortem examination.

Recognition of Symptoms.

It is unusual to find a sheep infested by only one kind of worm, but it is usual to find that one kind is more numerous and is chiefly responsible for the symptoms seen. Each type of worm produces special symptoms which can usually be recognised.

The more important parasites of of sheep cause the following symptoms:—

(1) *Large Stomach Worm or Barber's Pole Worm* (*Haemonchus contortus*).—This worm acts by draining blood from the sheep it affects. This causes paleness of skin and eye membranes; "bottle jaw" in bad cases; lack of stamina when driven; loss of condition not necessarily present (fat sheep may die); no scouring unless on lush pastures. Outbreaks generally occur from late spring to autumn.

(2) *Small Hair Worm or Small Intestinal Worm* (*Trichostrongylus*).—Loss of condition is the most noticeable symptom; affected sheep usually scour but this may not be severe if feed is dry. On green feed, typical "black scours" is seen. On dry feed, droppings may not be dark in colour. Symptoms are usually seen from autumn to spring. This parasite most commonly affects young sheep only.

(3) *Nodule Worm* (*Oesophagostomum columbianum*).—Loss of condition is also pronounced in sheep suffering from nodule worm; droppings are soft and contain slimy mucus and sometimes streaks of blood. Severely affected sheep have humped backs and stiff action of hind legs; tail often held up at an angle. If nodules are present in the rectum they can be detected with the finger. Symptoms are usually seen from late autumn to early spring.

Examination of Droppings.

The examination of droppings is a matter for trained technicians. A single sample is of very little value. Send about 10 samples from sheep which are thought to be suffering from worms and 10 from sheep in the same mob but which are thriving. Do not send mixed droppings from several sheep. Collect samples from individual sheep, either by waiting until droppings are passed by the selected sheep, or, preferably, by removing droppings from the rectum with one finger. Worm eggs in sheep droppings will hatch in 24 hours and counts taken after this period are meaningless.

A preservative must be added to the droppings. If samples are to be forwarded to the Animal Research Institute, Yeerongpilly, it is advisable to contact your district Sheep and Wool Adviser or Inspector of Stock beforehand.

[TO BE CONTINUED.]